The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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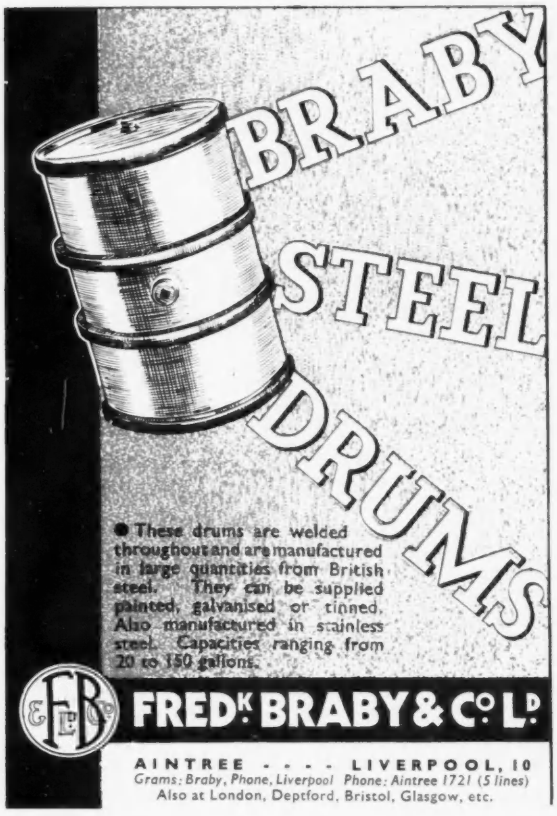

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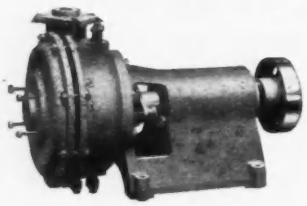

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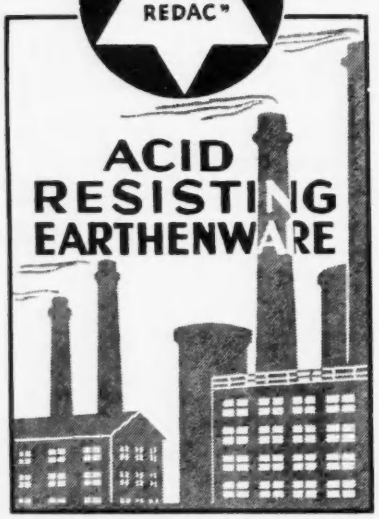

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Export Trade

GREAT BRITAIN occupies an insignificant area of the land surface of the world. With the exception of coal it has no special advantages in raw materials. It has insufficient land to produce food enough to feed the teeming population. Food, raw materials, and certain manufactured goods must be imported from other countries, and these in turn must be paid for by exports to the rest of the world. The British Empire is of only moderate assistance in securing this balanced flow of trade which enables us to live and to maintain our standard of living. It consists of great self-governing Dominions, all of whom have their own economic problems and must balance their own budgets, and with these a number of Colonies which for the most part require contributions from Britain for development and to enable them to balance their expenditure against income. The Empire is like a family consisting of parents, grown-up sons and daughters, who have made their way in the world and are independent, and others who have not yet achieved independence, but must receive help or allowances from their parents. A family cannot live by taking in each other's washing; nor can the British Empire. Both must do business with the outside world; both must receive income from the world outside for services rendered. No one will deny that the defeat of the Nazis must be our predominant objective; but this does not excuse a one-track mentality in which no thought is taken for the grey morrow that will dawn after this dark night has passed.

What can be exported now and during the continuance of the war depends on the Government. This decision ultimately depends on the judgment of the executives who form the permanent or temporary Civil Service; it has unfortunately no quality of omniscience or infallibility, but industry is compelled to accept Government decisions, curious though they sometimes are. Mr. Harcourt Johnstone, M.P., Secretary of the Department of Overseas Trade, has given the official view in a recent speech. He pointed out that as the war has progressed it has become possible and necessary for us to devote our production resources more and more to the direct needs of the war, to the concentration of industry at home, and to a more selective export policy. The essential question has become not how much we can export, but how much we must export in order to obtain the wherewithal to win the war and to maintain essential national economies overseas. The objective of advertising nowadays must be the maintenance of our prestige and keeping our export lines well in the memory of our overseas customers until the return of peace.

The great expansion of productive capacity in industry is causing many industrialists to consider that this rather negative and one-sided outlook towards the export trade is not enough. We must win the war, but unless we are prepared to put our people to work on peace-time production as soon as the war ends, the state of the country then may be no better than it is now. Some other nations are increasing their contacts overseas while we are doing little or nothing. We cannot rebuild Britain after the war unless we secure the financial means. The nation cannot afford to finance reconstruction out of taxation. Present taxation continued in peace time would cripple industry and stifle initiative. Consequently, the immediate post-war resumption of our export trade on a large scale is of fundamental importance. The chemical industry has special problems in this field due to the competition of vast and highly organised chemical industries in America and Europe. We are vitally concerned in organising our export trade so that we can start the peace on at least equal terms with our competitors.

Useful suggestions to this end have been made by a correspondent from China to *The Times* recently. They apply, with modifications, to other countries. For many years competition in China has been growing more severe, and, in future, if the foreign merchants want business, they will have to go out and seek it themselves. The German merchants showed the way after the last war. By their energy and ability, by learning the language and seeking business openings in the interior of China, they built up a substantial commercial position within a few years. If the British and other foreign merchants can adapt their methods to meet changed conditions, as they have always been able to do in the past, there is no reason why they should not maintain, and even increase, their volume of business. The clue is to be found in the necessity of working in closer collaboration with first-rate Chinese associates and in co-operation with Chinese enterprises. The day of the *comprador* is over; the need in the future will be for the associate manager of local origin.

Much the same conditions will apply to other countries. Will it not be too late for us to wait until after the war to create the necessary organisation? Individual firms and export groups should be making their plans now and arranging for representation in foreign countries. The start of a foreign office or indeed of any new office demands a great deal of spade work, and it will be found that our enemies are not neglecting this aspect of post-war economy. A resident manager, say, during the next six months might well be in a position to start work very actively by the time the war ends.

NOTES AND COMMENTS

I.G. and French Dyestuffs

FROM the piecemeal information provided by German interests about the formation of "Francolor," the 800-million-franc combine for the French dyestuffs industry, it is difficult to form a credible picture of what has actually happened. The transaction, however, is of special interest, not only because of the great values involved, but because it is typical of German industrial acquisitions in other European countries. The essential fact is that I.G Farbenindustrie has acquired a 51 per cent. interest in the entire French dyestuffs industry without any payment in cash or material apart from the transfer of an unspecified number of its own shares to the four French firms who had to give up their dyestuffs factories. Kuhlmann, Nord, St. Denis, and St. Clair-du-Rhône are not permitted to manufacture dyestuffs in their remaining plant and Francolor will not compete with the German producers in foreign markets, while I.G. Farbenindustrie has generously agreed not to supply France or French colonies with dyestuffs made by Francolor. The German company will also hand over to the new French company processes "the profitability of which in France is assured." The payments made to the French firms which had to hand over their dyestuffs factories have been calculated not on the basis of what the plant is worth, but "from the volume of business under consideration of German-French market differences." As the French dyestuffs makers only handed over their factories and I.G. Farbenindustrie did not pay anything to the firm for its 51 per cent. participation, Francolor has started business by incurring a large debt to pay for the stocks taken over. No wonder that even the long-suffering French chemical firms voice their dissent from the agreement which has, however, the approval of the Berlin and Vichy Governments!

Waste Paper Contest

TO stimulate the collecting and salvaging of waste paper, the Waste Paper Recovery Association is offering £20,000 prize money to be distributed among 20 areas into which the country has been divided, £1000 being allocated to each area. This will be divided among the local authorities in each area (city, town, urban or rural) which, between January 1 and 31 inclusive, collects most by weight of waste paper and cardboard per head of the population. The prizes are as follows: First, £500; second, £250; third, £100; and three consolation prizes of £50 each. The condition of the contest is that one-half of any prize money shall be given by the local authority to the Red Cross, Mrs. Churchill's Fund for Russia, R.A.F. Benevolent Fund, or to the Soldiers', Sailors', and Airmen's Families Association, and the remaining half to local charities.

Chemical Industry in the East Indies

WAR has embroiled the Netherlands Indies, bringing this hitherto peaceful region into prominence as a source of supply of many of the raw materials vital to the allies. Fortunately, as this brief review shows, chemical production in the East Indies has almost a purely local significance. Thus of the 1940 output of sulphur, unofficially estimated at 15,000 tons, some 80 per cent. was consumed on the spot by the various oil companies and the sugar industry. Official statistics reported in *Foreign Commerce Weekly* indicate that local production amounted to 16,003 metric tons in 1938 and 17,311 tons in 1939. During the past three years production has risen somewhat, chiefly owing to the discovery of new sources in the island of Celebes, where the mud and stone material of volcanoes contains sulphur to the extent of 40 to 60 per cent. Two factories—one in Celebes with an output of about 3000 metric tons annually, and the other of 12,000 tons—handle a large part of the raw material from these diggings. The demand for sulphur from the sugar industry has decreased during the past few years because of decline in sugar production, whereas the demand from the oil companies (manufacturing sulphuric acid in their own plants) has been maintained at about 6000 or 7000 tons a year. Local stocks of crude sulphur were reported to be at the usual low level in August, the chief consumers carrying about 3 months' supplies. Almost the entire output of phosphate rock, the only natural fertiliser produced in the Netherlands Indies, is consumed locally for the cultivation of oil palms, rubber and tea. Many deposits of both calcium and aluminum phosphate exist throughout the archipelago, but the chief centre of output is at Cheribon in Java, where the reserves are estimated at 500,000 metric tons. Actual production figures are not available, but a government official estimated production at 33,113 metric tons in 1938 and 18,777 in 1939.

Plastics and the Gas Industry

AMONG the many ways in which the gas industry is contributing to national defence is in the supply of essential raw materials for plastics production. A recent issue of the *American Gas Association Monthly* quotes an impressive list. Phenolic resins like Bakelite, polyamides like Nylon, and alkyds like Glyptal look to light oils and tar acids for their being. Methacrylates such as Plexiglas, vinyl resins such as Vinylite, and synthetic rubbers are produced from natural or refinery gas, while Neoprene is the child of coke. In fact, scarcely one among the purely synthetic resins and not many even among the semi-synthetics are independent of raw materials which the gas industry supplies in part. The use of plastics eases the war effort in two main directions. Innumerable articles required for the manufacture of modern implements of war are made from them, while in non-defence applications they can be substituted for strategic metals, rubber, and silk vitally needed for armaments.

LETTER TO THE EDITOR

Recovery of Used Lubricating Oil

SIR,—Regarding Mr. F. Frank's letter, published in THE CHEMICAL AGE of December 20, 1941, under the above heading, I think it should be made clear that the treatments discussed in both Mr. Walker's article and my comments, refer chiefly to crankcase oils removed from sumps of internal combustion engines. These oils, I think you will agree, present the greatest problem in recovery, although they are not necessarily of greater importance than such oils as transformers and turbines.

The statement in my last letter, with regard to the impossibility of forecasting the acidity of a treated oil by any of the methods mentioned by Mr. Walker in his article, is rather misrepresented by Mr. Frank through taking it out of its context, and treating it apart from the original article. The remark was prompted by Mr Walker's statement that Method No. 5, which does not require wide technical experience, produces a product from which "acidity should be quite removed." I am fully aware that it is possible to remove acidity, but my statement merely pointed out that it is not possible to give a guarantee of its removal by the method mentioned.

While on this subject, Mr. Walker's letter in THE CHEMICAL AGE of November 22, 1941, mentioned that "if necessary organic acid can be removed by an alkali wash as the first step in the treatment of the oil." This is patently true, but such a wash may prove (owing to the formation of difficult emulsions) damning to the process economically. It must be known that a process can be quite easily operated, and yet not be an economic success, owing to the time factor. Such processes can be made successful by increasing the throughput, but as the supply of used lubricating oil is limited, the throughput is also limited. There is another point to be borne in mind, *viz.*, that the treatment of oil for re-use by the owner himself differs from that of oil which is intended for disposal elsewhere.

Mr. Frank's notes on Continental practice are extremely interesting, and the fact that the U.S.A. practises oil recovery should be very encouraging to those engaged on this work in this country.—Yours faithfully,

L. SOULAL,
Refinery Manager.

December 22, 1941.

MOLECULAR DISTILLATION, III

Stills, Pumps, and Other Apparatus

by D. D. HOWAT, B.Sc., A.I.C., A.Inst.M.M., Ph.D.

(*Continued from* THE CHEMICAL AGE, *December 27, 1941, p. 325*)

ALL gaseous impurities, volatile fractions, and easily decomposable substances must be removed from the liquid before distillation is attempted and the maintenance of a satisfactory vacuum in the still will depend very largely on the success of preliminary treatment and degassing.

The removal of free fatty acids from organic oils, particularly fish-liver oils, by saponification with suitable alkaline is claimed by Hickman[14] to produce improved fat-soluble vitamin concentrates. An amount of sodium hydroxide or carbonate more than sufficient to saponify the free acid, but not exceeding 20 per cent. excess, is added to the oil and the mixture agitated. The soap is precipitated and the oil may be subjected to distillation treatment without washing or drying. The outstanding advantage of the operation is the odourless bland character of the distilled concentrates, particularly the lighter fractions. It was stated in the symposium[2] that nitrogenous materials may also be removed in this way. If their removal is not effected, deposits form on the heating surfaces of the still, seriously impairing the vacuum by the ensuing decomposition.

Degassing before Distillation

The importance of adequate degassing of the liquid prior to distillation cannot be overestimated. Any dissolved gases or highly volatile substances remaining in the oils may react harmfully with the valuable constituents, producing decomposition products which are frequently given off at certain stages in the molecular still, where they impair the vacuum and interfere with the distillation. The final pressure of absorbed gases in the oil should be reduced to less than 0.01 mm. and preferably to less than 0.005 mm. The pressures in the final stages of the degassing treatment should therefore be at least as low as the values given. Degassing consists, in fact, in subjecting the oil to the required low pressure for a sufficient time to allow equilibrium to be established between the gaseous phase and the volatile constituents in the body of the liquid.

The older types of degasser were of the splash type, being built up of a series of conical trays overlapping each other, each tray being inverted with respect to its neighbours above and below. As the liquid travelling from the feed at the top to the withdrawal point at the base, flowed over the trays, dropping from one tray to the next considerable splashing occurred. The body of the degasser was frequently divided into two portions by a liquid trap, the top portion connected to the rough vacuum stage and the lower to the medium vacuum stage of the backing pumps. A steam jacket or low temperature resistance element may be employed to maintain an elevated temperature in the degasser. These degassers were one of the least satisfactory features of the earlier still designs, failing to provide sufficiently violent agitation of the liquid to allow equilibrium to be attained between the gaseous phase and the volatile substances in the liquids. Such equilibrium is only attained very slowly unless the oil is very finely subdivided.

Two patents [15 and 16] describe a method of degassing in which the oil is subjected to the required reduced pressure while in the form of a rapidly moving highly agitated thin film. The method suggested involves passing the oil over a series of rotating plates which are maintained under reduced pressure. The pressure is progressively decreased, so that large volumes of absorbed gas may be removed in the first stages at relatively high pressures. The residual gas in minute amounts only requires treatment at greatly reduced pressures. With the centrifugal apparatus, degassing of fish oils to a value lower than 0.005 mm. requires a period of only a few minutes, generally less than one minute. The rate of removal of absorbed gases may be greatly accelerated by heating, a temperature not exceeding 100° C. being applied in the final stages. The only limit to the heating temperature is the danger of residual oxygen reacting with some of the easily decomposable constituents.

Molecular Stills

By definition, molecular distillation involves heating the fluid to the required temperature under a vacuum of about 0.005 mm., the vaporised molecules being condensed on a cooled surface separated from the evaporating surface by a distance less than the mean free path of the residual gases in the still. In practice the distance separating the condensing and evaporating surfaces will be about $\frac{1}{2}$ to 6 inches. To obtain efficient operation the evaporating and condensing parts of the still must be incorporated within a body which may be evacuated to the required low pressure. What is in theory a simple proposition becomes very complicated in its practical application. Problems attending the development of commercial scale stills are:

(a) Production of completely vacuum-tight apparatus.
(b) The supply of heat to the evaporators.
(c) The cooling of the condensers.
(d) The distribution of the liquids over the evaporating surfaces.
(e) The removal of the distillates.

A further problem, in many respects the most complicated of all, is the maintenance of the high vacuum in the relatively narrow spaces between the evaporators and condensers. A certain amount of non-condensable gas may be given off from the liquid during distillation and, collecting on the condenser, screens a definite area of condensation. As this gas may only escape in a sideways direction, the area of the condensers cannot be increased beyond an optimum limit, or the accumulation of gas in the middle of the condensing surfaces becomes so extensive that it cannot be removed rapidly enough, even by very powerful pumps.

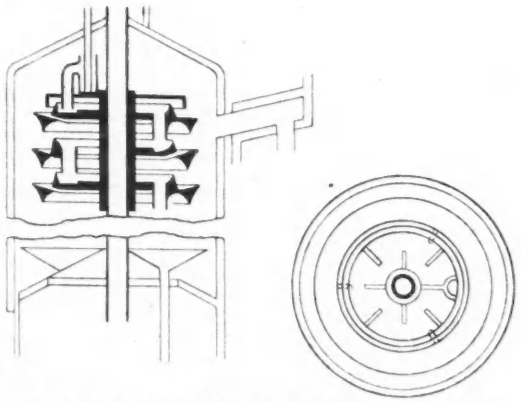

Fig. 10. Falling-film type of molecular still

One of the earliest developments was the production of a self-pumping still[17], *i.e.*, one in which the distilling vapours force the uncondensable gases to points at which they may be handled by the pumps. The earlier types were batch or discontinuous devices relatively simple in construction. The first continuous stills were made in the form of a series of horizontal trays acting as evaporating surfaces, the liquid being fed to the topmost tray and flowing thence by gravity. (Fig. 10). In this type six horizontal circular plates with inclined sides are heated by rheostat controlled elements immersed in lead in the central tube

on which the six plates are shrunk. Baffles are arranged on the plates so that the liquid falling on to a point near the circumference is forced to flow across the plate to the outlet diametrically opposite. The liquid residue is discharged from the last plate either through a liquid trap to another still or to the residue pump. The inclined sides of the plates are arranged to give a self-pumping action to the vapours generated on the plates. Condensed on the water-cooled outer walls of the still, the distillate flows down into a collecting channel from which it is led to the extraction pump.

A later type, referred to as a " falling-film " still, consists of a vertical surface heated to the desired evaporation temperature. A continuous film of liquid is distributed over the surface and flows to the discharge by gravity. Parallel to the evaporating surface and separated from it by ½ to 1½ inches is a condensing surface cooled to such a temperature as will allow efficient condensation of the vaporised molecules. Such stills may consist of a glass or metal tube evaporator, heated internally by circulating oil or resistance elements and maintained vertically within a water-cooled glass condenser. An alternative design employs a number of vertical steel tubes of rectangular cross-section welded to headers, some of the sections being used as evaporators and the remainder as condensers, while the whole assembly is enclosed in a rectangular container. Hot or cold oil may be circulated through the steel tubes making them function as evaporators or condensers. From specially designed distributors the liquid is fed in a continuous and even stream over the evaporating tubes without causing any sideways splash or leakage between two adjoining tubes. Flowing down the vertical surfaces the residue and distillate are collected in sets of troughs in the base of the container, the liquids flowing by gravity from the troughs to the extraction pumps. Burch and Van Dijck[2] state that four tons of distillate were produced per day from a still of this type measuring 1 ft. by 2½ ft. high by 2 ft. long and containing twelve 5-tube units for evaporation and thirteen similar units for condensation. They estimate that a similar type of container twice the height and length and five times the width of the one described should have a distillation capacity of 100 tons per day.

Weak Points and their Remedies

All types of molecular stills have two drawbacks: (a) low thermal efficiency; and (b) poor fractionating power. Low thermal efficiency, the outcome of high radiation losses, can be overcome only by improving the latent heat/radiation loss. Two possible remedies have been suggested by Fawcett[2], firstly, by reducing the temperature difference between the evaporators and condensers (though there is a practical limit to this in the danger of serious re-evaporation from the condenser), and secondly, by reducing the thermal emissivity coefficient of the evaporator.

The fractionating power of the stills is restricted by the preferential evaporation of the volatile constituents from the surface layers of the liquid during its passage over the evaporating surfaces. True equilibrium between liquid and gaseous phases in normal distillation is maintained by ebullition, a condition which does not obtain during molecular distillation. In a falling-film still rapid evaporation takes place from the surface layers, but in the absence of ebullition the only way in which the concentration of the volatiles in these layers may be maintained is by diffusion. Under the usual conditions the rate of evaporation of a volatile constituent is greater than its rate of diffusion through the film of falling liquid. To increase the efficiency and speed of molecular distillation more violent agitation of the liquid or the use of very thin films is essential. Some attempts have been made to produce in falling-film stills surface conditions in the evaporator which will not only assist in maintaining uniform distribution of the liquid, but promote turbulent flow with a view to ensuring more uniform composition. Detwiler and Markeley[18] have suggested roughening the surface of the distilling column by fusing over the entire area a coating of fragmented glass particles of the proper composition and size. The composition of the glass must be adjusted to give a melting point at least 100° C. lower than that of the column.

Producing a highly agitated thin film of liquid by centrifugal action appears to offer greater possibilities for increasing fractionating power and distilling speed. A centrifugal design consists essentially of two plates about ½ to 6 inches apart, attached to a common axle and capable of being rotated at high speed in a body which may be evacuated. One plate, heated by oil or by resistance elements, acts as the evaporator to the centre of which the liquid is fed. Centrifugal action spreads out the liquid in the form of a highly agitated thin film over the surface of the evaporator from the periphery of which the residual liquid is collected. The plate above the evaporator, suitably cooled by oil, constitutes the condenser, the distillate being withdrawn from an encircling gutter into which it is thrown by centrifugal action.

Centrifugal Pump Developments

The major developments in centrifugal pumps have been made by the Eastman Kodak and Distillation Products Companies under the direction of Dr. K. C. D. Hickman, and the design of important centrifugal types has been covered in two patents.[19] Burrows[13] has suggested the employment of certain types of these centrifugal stills in conjunction with a diffusion pump of a type already described, the whole being assembled within a common container which is evacuated by the pump. The design offers a particularly neat and compact arrangement avoiding restricted connecting passages between the pump and still. The design, shown in Fig. 3, employs the unit arrangement suggested by Burrows, comprising a diffusion pump and a centrifugal still. This modification of centrifugal still employs two rotating plates, the under surface of the top plate acting as the condenser and the lower plate as the evaporator.

The evaporator is heated by a bath of oil of very low vapour pressure, electric resistance heating elements being located in the bath. A series of baffle members fixed to the underside of the evaporator forces the heated oil to flow by centrifugal action through a double conical channel, raising the whole evaperating surface to a uniform temperature. The upper plate is made in a basin-shaped form, the rim portion being of smaller cone angle than the base. The liquid to be distilled, fed by a pipe to the centre of the top of the condensing tray, is thrown upwards and outwards by centrifugal force and is collected in a launder surrounding the upper edge of the rim. This procedure serves two purposes, keeping the condenser cool and allowing the oil in turn to become slightly preheated before it drains from the launder through a feed-pipe to the centre of the evaporator. Thrown outward by the rotation of the evaporator, the oil takes the form of a very thin film from which evaporation proceeds rapidly. Residual liquid is discharged from the periphery of the evaporator into the bottom launder which surrounds the rim. From this launder the liquid is finally discharged outside the still to gear-type pumps exhausting to atmospheric pressure. The distillate, condensing on the underside of the condenser plate, is thrown outward on to an annular conical member (marked A in Fig. 3) which is attached to the evaporator. This conical member extends upwards in the form of a rim parallel with the condenser, the outer edge registering with an intermediate launder. The distillate thrown off from the condenser rises along the upper surface of this conical member, finally discharging into the intermediate launder. Suitably designed baffles on the underside of the condenser prevent any distillate thrown up from discharging into the top launder.

Another suggested design of centrifugal type still[19] comprises a small diameter central evaporator with condensing plates located above and below, a launder being fitted around the periphery of each plate. The heated oil is fed to the centre of the evaporator while the condensers are kept cool by jackets fitted to the top and bottom of the still, a cooling liquid being made to circulate through the jackets.

In normal distillation opportunity occurs for condensation and re-evaporation of the molecules vaporised in the primary evaporation. In addition fractionating columns

are designed to condense a portion of the vaporised molecules (the reflux) making contact between this liquid and the vapour stream. In this way a much greater degree of fractionation of the distillate is made possible than with a single evaporation and condensation. In molecular distillation such procedure in a single unit is impossible, the maximum fractionating power of a molecular still being equivalent to one "perfect plate." Under the conditions obtaining in molecular distillation the degree of separation of the compounds in a mixture is the net result of a number of competing rates of evaporation, since all constituents must evaporate at some rate. A pure distillate cannot therefore be obtained.

In an endeavour to improve the poor fractionating power associated with molecular distillation, Hickman has designed a special type of centrifugal still.[19] This design

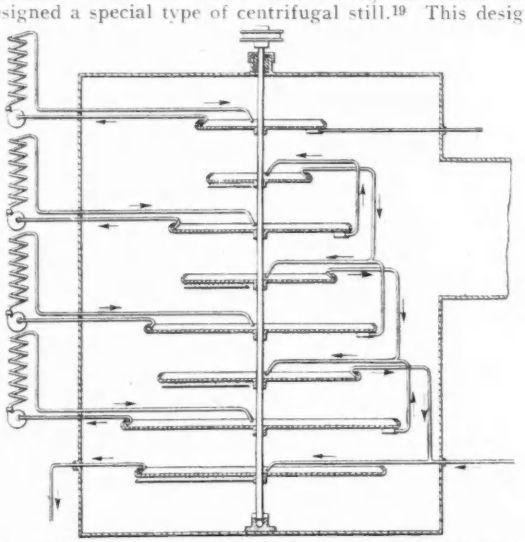

Fig. 11. Centrifugal type of molecular still with high fractionating power (Hickman)

(Fig. 11), claiming to give an improved fractionating power and to permit repeated redistillations without great loss of decomposable substances, incorporates a number of evaporating and condensing plates arranged in series and attached to a central rotating shaft. Four alternate plates act as evaporators, one section of the plate surface being heated by a resistance element and reflector. The cross-sectional area of the plates from the bottom up decreases progressively according to a geometric ratio such as $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, allowing closer control of the extent of evaporation. In the absence of careful and constant control complete distillation on each zone might take place, and no fractionation would result. Condensing plates, alternating with the evaporators, are cooled by the circulation of oil of low vapour pressure over the upper surfaces. The oil, fed to the plate centre, is withdrawn by a scoop placed just beneath the flanged outer edge. The centrifugal action, reinforced if necessary by an external pump, forces the oil through an external cooling coil from which it is recycled to the condensing plate. On the underside of each condenser, on the opposite side from the heated section of the evaporating plate, is a specially designed scoop for the removal of the distillate which collects on these surfaces. This scoop, consisting of a rectangular hollow conduit, lightly touches the under surface of the plate; and, constricted at the end not in contact with the plate, is connected to a delivery pipe. The open end of the rectangular conduit faces in a direction opposite to that in which the plate is rotating. By this means the rotating condenser, acting as a pump, forces the condensate up a pipe which delivers it to the centre of the evaporating plate above.

In operation the liquid to be distilled is delivered to the centre of the lowest evaporating plate, from the edge of which the undistilled residue is removed by a scoop for discharge. The residue from the next evaporator in the series joins the main feed pipe and is returned to the lowest evaporating plate. The condensate from the lowest condensing plate, forced by centrifugal action up through the discharge scoop, is delivered to the centre of the evaporator above. Also joined with this liquid stream is the undistilled residue from the succeeding higher evaporator. This cycle is repeated throughout, the condensate being forced up to pass over successive evaporators while the undistilled residue is flowing countercurrent down through the still. The final distillate is withdrawn from the under side of the top condenser and the final undistilled residue from the heated section of the lowest evaporator.

Not only the area, but the temperature of evaporation on each plate is varied to give the best fractionating conditions, while in common with all molecular distillation stills the evaporating and condensing surfaces are separated by distances less than the mean free path of the molecules—the figures suggested being from $\frac{1}{2}$ to 6 inches.

The advantages claimed by Hickman for this particular design of still are:

(a) Fractionating-power is improved;
(b) thermal decomposition is reduced to a minimum as distillation takes place so rapidly from the thin film;
(c) a number of different fractions may be recovered, by adjusting the temperature of the evaporating surfaces and recycling the material, each compound being fractionated to a degree corresponding to the number of temperature or distilling zones in the still; and
(d) pumps for recirculating distillate fractions are not required.

The measurement of the absolute pressure in a molecular still is not usually necessary in routine operation, the performance of the still being independent of the pressure, provided that that pressure is low enough. A simple check that the pressure is not rising above a maximum limit—say 10^{-3} mm.—may be furnished by a simple electric discharge tube. This may be made of such dimensions that when an approximately standard voltage is applied no discharge is visible at pressures below 10^{-3} mm.[2]

In studying the effects of pressure variation on still efficiency and in the design of commercial stills an absolute pressure gauge is essential. Such a gauge will require to measure pressures of about 10^{-6} mm. caused by condensable organic vapours. The McLeod gauge is not suitable for use with condensable organic vapours. According to Fawcett[2] the two types which have proved most efficient in I.C.I. (Alkali), Ltd., laboratories are the Knudsen or thermal repulsion gauge and the Pirani gauge. The Knudsen gauge is rather too sensitive for routine operation on stills, but has proved of great value in design work. The readings obtained with the Pirani gauge operating with condensable organic vapours are too high, while the sensitivity slowly falls off until the readings obtained bear

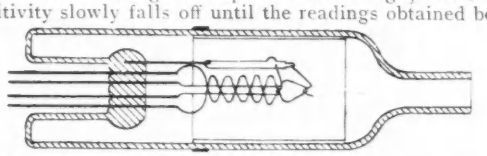

Fig. 12. Ionisation gauge : construction of tube (Morse and Bowie)

no relationship to the original calibration. This effect may be due to absorption of organic vapours in the filament and walls of the gauge and to the decomposition of the vapour by the hot filament.

R. S. Morse and R. M. Bowie,[20] of Distillation Products Inc., have designed a new type of ionisation gauge capable of measuring pressures less than 10^{-6} mm. They state that to measure pressures approaching 10^{-8} mm. it is essential that:

(a) Electrical leakage to the plate should be small;
(b) internal parts should be easily freed from occluded gas;
(c) sensitivity should be reasonably high; and
(d) connection between the bulb and vessel should be short and of large diameter.

The gauge, shown in Fig. 12, is made of Pyrex glass with an abnormally large tabulation inside diameter ⅛ in. The gauge may therefore be sealed directly to a hard glass system and rapid equalisation of pressure variation obtained. The plate or collector consists of a thin slightly translucent platinum film deposited over a portion of the inner wall of the bulb, electrical contact being effected by a thin wire entirely embedded in the glass. The external plate contact takes the form of a metallised ring round the centre of the bulb. In the absence of protruding leads, the bulb may be torched freely and so easily freed of occluded gases. Leakage resistance between the plate connection and the other leads is extremely high owing to the long glass path separating them.

The grid is a reverse spiral of heavy tungsten, both ends of which are brought out to separate leads. A filament of pure tungsten has proved most efficient. Pressures above 10^{-3} mm. have not resulted in damage to the gauge, while continued exposure to pressure below 10^{-7} mm. has caused no change in emissivity after the first day's operation. The sensitivity claimed for the gauge is from two to five times the best values reported previously, the higher sensitivity being attributed to the relatively larger volume between the grid and the plate in which ionisation takes place and to the open nature of the grid. For pressures below 10^{-4}mm. the pressure varied in direct proportion to the plate-current. Such an instrument will prove of great value in design problems and in investigations of still efficiency in relation to pressure variations.

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Personal Notes

MR. HAROLD GIBSON is reported to have joined the engineering staff of I.C.I. (Fertiliser and Synthetic Products), Ltd.

MR. N. LEWTON-BRAIN is understood to be engaged on chemical engineering problems in the research and development section of Magnesium Elektron, Ltd.

MR. H. E. ZENTLER-GORDON has been appointed Development and Research Engineer with the Manganese Bronze and Brass Co. Ltd., Dynaflex Division.

MR. S. LINFOOT has become a senior technical assistant on the Regional Development Staff of the Ministry of Supply where he is concerned with the chemical engineering side of factory problems in ordnance works.

MR. H. L. S. ATKINS and MR. L. D. STUART have both joined Messrs. May and Baker, Ltd., manufacturing chemists, as personal assistant to the Director of Production and design engineer respectively.

PROFESSOR H. L. RILEY, Professor of Chemistry at King's College, University of Durham, was the chief guest at the annual reunion dinner of the Old Keighlians' Association on January 2.

MR. J. K. ANDERSON, of Leeds, chairman of Fairbairn, Lawson, Coombe, Barber and Co., Ltd., textile machinery manufacturers, has resigned from his post as North-Eastern Regional representative of the Ministry of Supply.

F/O. G. R. SCORER, B.Sc., recently awarded the D.F.C., was on the technical staff of Meldrums, Ltd., engineers, Timperley, Cheshire.

MR. GEOFFREY HEYWORTH has been appointed chairman of Lever Brothers and Unilever, Ltd., in succession to the late Sir Francis D'Arcy Cooper. Aged 47, he has served the company since leaving school.

The New Year Honours include the award of a C.B.E. to MR. A. WILSON, director of I.C.I. (Explosives), Ltd., and of an O.B.E. to MR. G. H. MACKENZIE, assistant production engineer to the same company.

MR. F. H. LEES, F.I.C., chief analyst and head of the control laboratories, Wellcome Chemical Works, Dartford, retired at the end of 1941 after 42 years' service with the company. DR. G. E. FOSTER has been appointed to succeed him.

MR. J. BENNETT, director of Henry Gardner and Co., metal merchants, has been appointed by the Ministry of Supply to the Rubber Control Board, membership of which is now complete. The other members, as reported in our news column last week, are SIR GEORGE BEHARRELL (chairman), SIR WALROND SINCLAIR, MR. W. G. ESSEX, and MR. R. S. THOMPSON.

DR. FRITZ FEIGL, the eminent Viennese chemist, is now in Rio de Janeiro, where he is organising a spot-test analysis department in the laboratories of the Brazilian Ministry of Agriculture. His forced migrations took him from Vienna to Belgium and thence to a concentration camp in France which he was fortunately able to leave after a few months.

Obituary

MR. WILLIAM NELSON, B.Sc., of Dundee, who was killed with his wife, in a motoring accident at Birmingham on Christmas Day, held an important post with I.C.I., Ltd., at Birmingham.

PROFESSOR SEBASTIAN G. M. URE, M.A., B.Sc., M.I.Chem.E., who died on Christmas Day at the Royal Masonic Hospital, aged 60, was a notable figure in the world of chemical engineering, and was passionately devoted to his profession, having been known to spend his holidays in a ship's engine-room. He was a thorough Glaswegian, having been educated at Allan Glen's School and the University of Glasgow. His practical engineering experience was gained first with a firm of shipbuilders, then at a Royal Ordnance Factory in South Wales (during the last war), and finally with a City firm of consultants. From 1921 he taught chemical engineering at the Imperial College, first as lecturer under Hinchley and later as Assistant Professor. He was closely associated with the Institution of Chemical Engineers, filling the post of Honorary Editor in 1926-36, and serving as Vice-President in 1937-38 and as a Member of Council since.

New Control Orders

Paint, Lacquer, and Varnish

THE Minister of Supply has made an Order, entitled the Control of Paint, Lacquer, and Varnish (No. 1) Order, 1941, relating to the acquisition, use, treatment, and consumption of paint, lacquer, and varnish containing tung oil, oiticica oil, stillingia oil, drying oil made from castor oil, or thickened or mixed oil of which any of these oils is an ingredient. Disposal of such paint, etc., by the manufacturer is prohibited except under licence, or for Government use, and similar restrictions apply to the use or treatment of such paint, etc., by the manufacturer. Applications for licences should be addressed to the Raw Materials Dept., Ministry of Supply, Warwick, and for the time being no licences for civil use will be issued. The Order (S.R. & O. 1941, No. 2076) came into force on December 26, 1941.

Hydroquinone K.I.D. Exemption Suspended

The Treasury has made an Order renewing until June 30, 1942, the exemption from Key Industry Duty of all articles at present exempt, except hydroquinone.

Metallurgical Section

Published the first Saturday in the month

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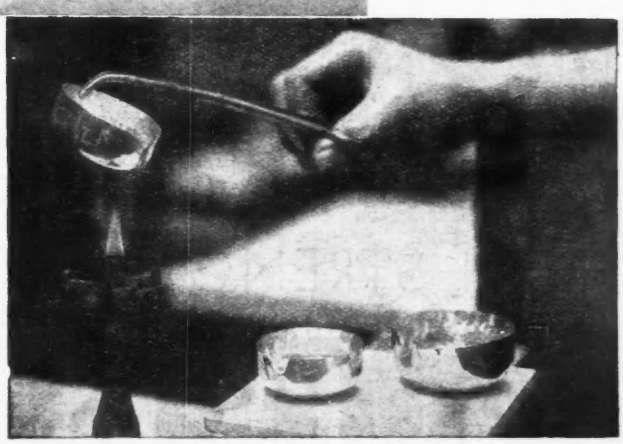

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Metallurgical Section

January 3, 1942

ALLOYS FOR SPRINGS*

Development of Beryllium-Bronze

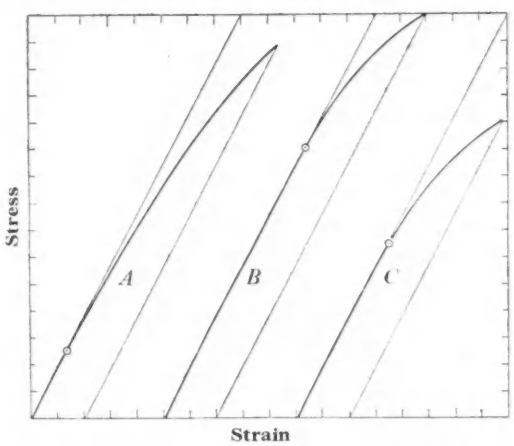
SPRINGS are vital parts of many instruments, and consequently the selection of the most suitable material in the correct condition is an important consideration. Much valuable information on the subject is given in a paper by Moore and Beckinsale (*J. Inst. Metals*, 1927, *37*, p. 111) who point out that " . . . the form, dimensions and modulus of elasticity determine the strength of the spring. In addition the qualities required in a hairspring are perfect elasticity throughout the maximum range of deflection applied, permanence and invariability of elastic properties and of form and dimensions when unconstrained or under a given torque, and resistance to corrosion."

For the development of the necessary elastic properties in metals and alloys enabling them to be used as springs, heat treatment is necessary, either alone or after cold working. Thus, carbon steels, which are so frequently used for springs, require to be hardened and tempered, and phosphor bronze, also largely used, should be cold worked (rolled or drawn) and reheated at a relatively low temperature, such as 200° C.

The stimulus to research given by the discovery of duralumin and the remarkable increase in its hardness and strength brought about by heat treatment have resulted in the accumulation of a great deal of knowledge regarding the phenomena included generally under the term precipitation hardening, and the recognition of such properties in a number of non-ferrous alloys besides the aluminium alloys. Some of these alloys, of which examples are beryllium-copper, beryllium-nickel-copper, aluminium-nickel-copper, silicon-nickel-copper, have found uses as springs or hold out possibility of such uses. Of these beryllium-copper, generally known as "beryllium-bronze," has been particularly developed as a material for springs, and a brief note on this alloy may be of interest.

Beryllium-bronze, an alloy of copper with some 2-2.5 per cent. of beryllium, has pronounced precipitation hardening qualities. At 800° C., the solid solubility of beryllium in copper is about 2 per cent. and is very small at room temperature, being only 0.4 per cent. at 400° C. By quenching from a temperature such as 800° C., beryllium is retained in supersaturated solution in which very marked precipitation hardening occurs on reheating (tempering) at a temperature of 300-350° C. In this condition beryllium bronze has a high limit of proportionality and also, what is of great importance in alloys to be used for springs, good fatigue properties, as shown by a high endurance range, and good resistance to corrosion. Marked grain growth occurs in the straight beryllium-copper alloys during solution treatment at 800° C. The addition of 0.25-0.5 per cent. of nickel to beryllium bronze prevents excessive grain growth and gives a much more finely crystalline alloy after treatment.

Most metals when fully annealed have only a very low, if any, elastic limit. Cold working raises the tensile strength, but does not correspondingly raise the true elastic limit. Using measuring instruments of good sensitivity, it will be found that the range of proportionality of stress and strain is small in cold worked metals and that the departure from proportionality, although it is not great over a considerable further range, progressively increases with increase of stress. The poor elastic properties which a material has after it has been cold worked are generally improved by allowing it to remain at room temperature and in some cases, *e.g.*, very mild steel, recovery may be almost completed by such " ageing." As a rule, however, a special heat treatment is required to give a useful range of proportionality of stress and strain. This treatment consists in reheating the cold worked material to a temperature well below that at which noticeable recrystallisation or appreciable softening occurs, generally between 100° and 300° C., for a time depending on the temperature and degree of cold working. The changes brought about in this way are shown in the diagram herewith, in which



Changes in the stress/strain relation of alloys brought about by heat treatment and working

curve *A* represents the stress/strain curve of the cold worked material, curve *B* that of the cold worked material reheated to give the best elastic properties and curve *C* after treatment at a higher temperature, resulting in a lowering of the limit of proportionality, although this is still well above that of the original cold worked metal.

The majority of non-ferrous alloys used for springs, of which examples are phosphor bronze and nickel silver, depend on cold working, usually a high degree of cold working, for their elastic properties, and this should be followed by a low temperature heat treatment. Accompanying the improvement in elastic properties brought about by low temperature heat treatment is the relief of internal stresses, and consequently the reduction or complete elimination of the danger of failure by season cracking, if the material should be liable to this defect. It should also be noted that the operation of coiling or otherwise forming the spring from the hardened material is a cold working operation which impairs the elastic properties, and a final low temperature treatment is required to effect a recovery.

Although elastic properties—elastic range and modulus—are the first consideration in alloys for springs, other properties such as resistance to corrosion, coefficient of expansion, constancy of elastic modulus, and electrical conductivity, may be of great importance. The high resistance to corrosion of the non-ferrous alloys used for springs

* From an article on " Alloys for Instruments," by O. F. Hudson, A.R.C.S., D.Sc., British Non-Ferrous Metals Research Assn. (*J. Sci. Inst.*, 1941, *18*, 11, p.213).

is one of their principal advantages, and certain nickel steels and nickel iron alloys, while also being highly resistant to corrosion, have other special properties which make them particularly valuable in some cases. Thus the nickel steel known as Invar (36 per cent. nickel) has an almost negligible coefficient of linear expansion, and Elinvar, a chromium-nickel-iron alloy with some manganese, tungsten and carbon, has a practically constant modulus over the range −50° to 100° C. As originally introduced Elinvar contained 12 per cent. chromium and 36 per cent. nickel, but a more recent composition is: nickel 33-35 per cent., iron 53-61 per cent., chromium 4-5 per cent., tungsten 1-3 per cent., manganese, silicon, carbon each 0.5-2 per cent. Further improvements have been made by additions of molybdenum and vanadium (Métélinvar) and aluminium and titanium (Durinvar) giving alloys having precipitation-hardening properties. After suitable heat treatment these materials have elastic properties (elastic limit and stiffness) superior to Elinvar.

New Ternary Alloy

Beryllium-Cobalt-Copper

AN improved ternary alloy, developed from the original beryllium-copper alloy by the addition of a small percentage of cobalt, has recently been placed on the market by Mallory Metallurgical Products, Ltd., 73 Hatton Garden, London, E.C.1. Improved and more uniform physical properties are claimed for it. This alloy, known as Mallory 73 Beryllium-Copper, is available as strip, wire, and tube in the soft state for forming. After forming, a short precipitation hardening process develops maximum physical properties—a tensile strength up to 90 tons per square inch, a proportional limit of 50 tons per square inch and a hardness of 360-400 Brinell are the figures given by the manufacturers. The combination in this alloy of exceptionally high tensile and fatigue strengths, high hardness, electrical conductivity and resistance to wear and corrosion make it useful where these properties are demanded for heavy duty springs, current carrying parts of electrical equipment, instrument diaphragms and a variety of other components of precision equipment.

The Recovery of Indium

Purification Method Outlined

A METHOD for the recovery of indium metal from old plating baths is outlined by J. R. Dyer, jun., technical director of the Indium Corporation of America (*Chem. Ind.*, 1941, *49*, 3, 339). The solutions are first evaporated to dryness and then subjected to a mild ignition, that is, until all the organic matter has burned off. Then the temperature is raised until the cyanide and carbonate salts fuse, and the temperature is maintained until the melt is quiet. The molten melt may then be poured into moulds, or allowed to solidify in the crucible. Upon cooling it will be found that the indium has been reduced to metal and will be segregated at the bottom of the mould. These are then dissolved in water and the metallic indium, silica, etc., filtered off. These may then be dissolved in hydrochloric acid and subjected to electrolysis for further purification.

The solution should be carefully acidified under a good fume hood and any indium therein recovered by precipitating as indium hydroxide. This may then be reclaimed as follows. The hydroxide is dissolved in a strong solution of hydrochloric acid and the solution subjected to a plating current of about 7½ volts. The cathode will have all the indium, a possible trace of iron, tin and nickel. The cathode is then made the anode with a sulphuric acid electrolyte and the indium again plated out. Tin, nickel and iron will remain in solution. The indium will be of high purity with a possible trace of iron.

It is stated that it is possible by this means to recover almost the entire amount of indium, except where there is a large amount of iron present in the bath. In such cases the recovery is stated to be at least 75 to 80 per cent. of the indium.

Magnesium Die Castings

Chemical Anti-Corrosive Treatments

CHEMICAL treatments are used on magnesium die castings to provide increased corrosion resistance, a base for organic coatings, or decorative effects, according to a report made by H. W. Schmidt, Dow Chemical Co., to the American Society for Testing Materials at Philadelphia (*Chem. Met. Eng.*, 1941, *48*, 9, 164).

A chrome-pickle treatment is normally given to all magnesium die castings to protect the metal during transport, storage, and machining. The treatment will remove 0.008-0.002 in. of metal from the surface and is not recommended on machined surfaces where close dimensions must be held. The following solutions may be used:

(a) Sodium bichromate ($2H_2O$)	1.5 lb.
Conc. nitric acid (sp. gr. 1.42)	1.5 pt.
Water to make one gallon.	
(b) Chromium trioxide...	1.0 lb.
Conc. nitric acid (sp. gr. 1.42)	0.9 pt.
Water to make one gallon.	

Temperature of the solution should be 51-57° C., and time of treatment 10 sec. After removal from the treating solution, the castings should be exposed to the air for about 5 sec. before rinsing thoroughly in cold water and then in hot water to facilitate drying.

A modification of the chrome-pickle treatment, which will give increased corrosion resistance, consists in boiling in a bichromate solution. The die casting, which has been previously chrome-pickled, is immersed for 30 min. in a bath containing 1-2 lb. of sodium, potassium, or ammonium bichromate per gallon. The bath is maintained at boiling temperature and the solution is controlled to a *p*H of 4.0-4.4.

Hydrofluoric Acid Treatment

Another treatment, with hydrofluoric acid, gives practically no change in dimensions. Parts are immersed for 5 min. in a solution containing 15-20 per cent. by weight of hydrofluoric acid, and then are rinsed thoroughly in cold water, boiled for 45 min. in a solution containing 1-1.5 lb. of sodium bichromate per gal. and then rinsed thoroughly in cold water followed by a dip in hot water. The concentration of the acid should not be allowed to fall below 10 per cent.

Alternatively, parts may be immersed for five min. in a 15-20 per cent. HF solution, washed thoroughly in cold running water, and boiled for 45 min. in the following solution:

Ammonium sulphate	4 oz.
Sodium bichromate ($2H_2O$)	4 oz.
Ammonia (sp. gr. 0.880)	½ fluid oz.
Water to make one gallon.	

Depletion of the bath is indicated by non-uniform or pale coatings, slowness of coating formation, and by an increase in the *p*H to about 6.2. To revivfy the bath, add a solution containing equal parts by weight of chromic acid and concentrated sulphuric acid (sp. gr. 1.84) until the *p*H is decreased to 5.6. The best operating range of the bath is a *p*H of 5.6-6.0. Wash thoroughly in cold water and boil for at least 5 min. in a solution containing one oz. of arsenious acid per gallon. Because of the low cost of this bath no control is advocated.

With the chrome-alum treatment, parts are immersed in a boiling solution of the following composition:

Potassium chrome alum ($24H_2O$)	4 oz.
Sodium bichromate ($2H_2O$)	13.3 oz.
Water to make one gallon.	

Time of treatment may range from 2 to 15 minutes. On removal from the bath, the parts should be rinsed thoroughly in cold water and then in hot water to facilitate drying. The solution may be revivified by the addition of sulphuric acid not exceeding 0.33 fluid oz. per gal. or just sufficient to redissolve a brown precipitate that settles out. The solution should then be boiled. It is best controlled by additions of sulphuric acid to maintain the *p*H between 2.5-3.5. The *p*H of a depleted solution is 5.5.

Test Codes for Furnaces

Open-Hearth Steel Furnaces

THE British Standards Institution has published a Test Code for Open-Hearth Melting Furnaces for the Refining of Steel, B.S. 979, which should be of particular interest to the gas oil and solid fuel industries. Difficulties and misunderstandings arising in the correlation and comparison of results obtained in different tests, owing to the lack of agreed standard testing procedure and technique, led to the setting up of a representative committee by the Institution to prepare standard methods of carrying out the tests for a wide range of fuel-consuming plant.

The Code just published has been prepared to cover the testing of open-hearth melting furnaces for the refining of steel. It provides for two forms of test, *viz.*: *Part* 1. A short, simple code for carrying out, at a minimum cost, simplified industrial tests for evaluating the performance of furnaces as effective and economic units; *Part* 2. A comprehensive code for the complete evaluation of the performance and the efficiency of furnaces.

Part 1 is recommended as a guide to enable simplified tests to be carried out and is proposed to cover performance of the furnace as an effective and economical heating unit. *Part* 2 has been drafted to evaluate the efficiency, performance, and output of a furnace and aims at indicating the method that should be adopted and the data that should be obtained. It is as comprehensive as practicable from the standpoint of the conditions existing in the industries concerned. It excludes reference to data which are not essential to a complete analysis and evaluation of the operation of the furnace concerned. This British Standard Comprehensive Code would be too comprehensive for contract conditions between manufacturers and purchasers, and the British Standard Industrial Code in *Part* 1 is recommended for this purpose.

Furnaces for Non-Ferrous Metals

A Test Code for Fuel Fired Melting Furnaces used in the Non-Ferrous Metals Industry has also just been published, as B.S. 992, by the same Institution. In the past the lack of an agreed standard testing procedure and technique has occasioned many difficulties and misunderstandings in the correlation of results obtained in different tests to evaluate performance and efficiency of these furnaces, and in 1935 the Gas and Solid Fuel Industry Committees of the Institution appointed representative committees to prepare standard methods of carrying out the tests.

The code has been framed to cover the testing of furnaces for the melting of non-ferrous metals. It provides for two forms of test, *viz.*:—*Part* 1. A short, simple code for carrying out, at minimum cost, simplified industrial tests for evaluating the performance of furnaces as effective and economic units. *Part* 2. A comprehensive code for the complete evaluation of the performance and the efficiency of furnaces.

The code is applicable to crucible furnaces for copper melting, brass melting, gun metal melting, and aluminium melting; to pot furnaces, cast iron or plumbago for aluminium melting and type, lead, and stereo metal melting; and to reverberatory or potless furnaces. It is also applicable to certain furnaces used in other industries.

The Code may not be applicable to all furnaces now existing or likely to be evolved in the future, but nevertheless it will serve as a guide. The application of the Code is fully practicable in the cases where solid or liquid fuels, town gas, blast-furnace gas, coke-oven gas, mixed gases, or other clean gases are used. When hot raw producer gas is employed difficulties arise, although it is a more or less simple matter to ascertain the heat input when the gas producer is an integral part of the furnace.

In the case of a furnace fired by its own remote gas producer plant, but connected thereto by gas mains or flues, the furnace and producer may be considered as one unit and the thermal statement be based on the fuel supply to the producer, unless satisfactory means are available for measuring the hot raw gas in the actual mains supplying the furnace. Even when gas quantities can be measured directly, the efficiency of the gas producer plant should be considered and due allowance made for: (a) the thermal value of the tars and carbonaceous dust deposit in the mains or flues connecting the producer to the furnace; and (b) the loss of sensible heat of the gas in its travel from the producer to the furnace.

In the case of a furnace fired by raw producer gas from a main or flue common to other furnaces, and supplied with gas from a single producer or battery of producers, it is difficult to determine the thermal input to the furnace with the preciseness essential for recommendation in a British Standard. Nevertheless, with the equipment now available, it is possible under favourable conditions of application to make a reasonable check on the thermal input to the furnace, provided due allowance is made for the errors likely to occur when measuring the flow and heat content of raw producer gas.

Copies of the above Test Codes may be obtained from the British Standards Institution, Publications Department, 28 Victoria Street, London, S.W.1, No. 979, 5s. 6d. post free; No. 992, 3s. 9d. post free.

American Lead Supplies

Priority Control Set Up

ALL supplies of lead in the United States, domestic and imported metal, have been placed under full priority control, and an allocation system has been established. Requirements for defence and civilian purposes have created a shortage of home-produced lead. Current consumption is at the rate of approximately 960,000 tons a year with an appreciable increase in view. Current production, including that from foreign ores, is not over 600,000 tons. The difference is made up from scrap returned to the industry and from foreign imports. All foreign pig lead is now being purchased by the Metals Reserve Co. and allocated by the Lead Branch of the Office of Priority Management. The new order extends control to domestic lead and formalises the action through the customary channel of the Director of Priorities.

SOUTH AFRICAN IRON RESEARCH

In the millions of tons of titaniferous iron ore occurring round the Bushveld Igneous Complex, the Union of South Africa appears to possess an asset of great potential importance. Although very little use is made of this material elsewhere, it seems that it ought to be possible to utilise its iron content, while the titanium oxide might be extracted and used as a substitute for white lead in paint, and the vanadium oxide content also turned to account. Some preliminary work has been done on this problem at the Metallurgical Laboratory of the University of the Witwatersrand, and an investigation has also been made as to the possibility of finding further uses for the considerable quantities of chromite found in the same formation, such as in stainless steel manufacture and as a component of refractory brick.

PERUVIAN MOLYBDENUM

Practically all the molybdenum produced in Peru is in the hands of one concern—Peru Molibdeno—situated at Juaja, Dept. of Junin. Exports of molybdenum concentrates in 1940 amounted to 363.6 metric tons, and in the first half of 1941, 206.3 tons, the concentrates averaging about 80 per cent. MoS_2. The 1940 exports went to Japan, while in 1941 125 tons went to Japan and 81 tons to Mexico. The shipment to Mexico was obviously intended for Germany, as it was aboard one of the German ships destroyed when attempting to leave port. The contract held by the company with Japan for its entire output expired last month, and an agreement has been reached whereby Britain will purchase the total production in 1942.

General News——From Week to Week

A new margarine containing more vitamin D in one ounce than an average egg is due to reach the public early this month.

The new address of Messrs. Huson and Hardwick, analytical and consulting chemists and samplers, will be 7 Leather Lane, Liverpool, 2. Telephone (temporary): Advance 1528.

Provision is made under the Export of Goods (Control) (No. 45) Order, 1941 (S.R. & O., 1941, No. 2020) for licences for the export to all destinations of manufactures of balata, gutta-percha, and rubber of all kinds.

A booklet showing the position, as at December 1, 1941, of the goods affected by the Export of Goods (Control) (Nos. 39, 40 and 41) Orders, 1941, has been prepared by the Board of Trade. The booklet, which has an index, can be obtained from H.M. Stationery Office, price 9d.

The Ministry of Food announces that the only change in the existing prices for oils and fats allocated to primary wholesalers and large trade users during the five weeks, ending January 31, 1942, is as follows: Rapeseed oil, crude, increased by £2 per ton to £46 5s.

The Minister of Supply has made the Control of Rubber (No. 2 and No. 3) Orders, 1941 (S.R. & O., 1941, Nos. 2094, 2098), respectively prohibiting and restricting the production of certain articles of crude rubber, latex, gutta-percha, or balata. Dates of coming into force are December 29, for No. 2, and January 5, for No. 3 Order.

Although, owing to war conditions, it has not been possible for them to send out complete diaries as hitherto, we are very grateful to the Staveley Coal and Iron Co., Ltd., for the 1942 refills for their standard pocket diary. We are happy to say we have carefully kept last year's cover and shall be able to enjoy the benefit of this useful gift.

Under a Board of Trade Order, which came into force on December 29, Brazil, Chile, Colombia, and Peru are removed from the list of countries to which all goods are prohibited to be exported without licence. All goods on Lists "A" or "B" of the Schedule to the Export of Goods (Control) Orders remain subject to licence.

In a New Year message, Lord Dudley Gordon, President of the Federation of British Industries, comments on the severe strain that British industry has had to bear during the past year and asserts that industry confidently re-echoes the words of the Prime Minister when speaking of the task before us: "We must not be found unequal and we shall not be found unequal to it."

A new quarterly period of insurance of business equipment under Part II of the War Damage Act, beginning on January 1, runs until March 31, 1942. The premium for this period is 7s. 6d. per £100. Insurance is compulsory where the value of the business equipment held exceeds £1000, and all those who are compulsorily insurable or wish to be covered against war damage, and who have not already taken out a six-months' policy, should apply to their Fire Insurance Company or Lloyd's for insurance for the three-months' period.

Foreign News

Production of iron pyrites in Spain is officially reported as having amounted to 239,211 metric tons during the first six months of 1941.

Shipments of gasoline and crude oil from Peru during the first half of 1941 were recorded at 599,612 metric tons, compared with 654,073 in the corresponding period of 1940.

Beryllium is now being produced in South West Africa from a deposit of the mineral opened up at Karibib by Jooste Lithium Mines, Ltd. An output of ten tons was recorded for last March, the first month of operation.

To establish closer co-ordination between manufacturers and research institutions, the Indian Chemical Manufacturers' Association has requested certain Indian Universities, engaged on research work, to include representatives of chemical and drug manufacturers on their advisory boards.

The important chemical and synthetic rubber works of the I.G., at Hüls, near Crefeld, received another visit from the R.A.F. last Sunday night. An explosion of great violence, followed by extensive fires, was reported as occurring in the centre of the factory at 8.50 p.m.

U.S. monthly statistics on zinc dust show that production in 1941 will exceed that in any previous year. In May, 10 plants reported an output of 4,011,534 lb. of zinc dust, and in August this figure had risen to 4,383,408 lb. The average monthly production of the previous year was 3,550,000 lb.

The bulk of the pyrethrum produced and exported in Kenya continued to be shipped to the U.S.A. during June and July, 1941. During June, 1941, 835 tons out of a total of 990 tons, were shipped to the United States, and in July, 200 tons, out of a total of 348 tons exported.

Construction of a new plant for the manufacture of chlorinated hydrocarbon solvents has started at Wyandotte, Michigan, for the Du Pont Company. The plant, a unit of Du Pont's R. & H. Chemicals Department is expected to be ready in the summer of this year.

Mercury production in the United States during September reached a record level for recent years; output amounted to 4200 flasks compared with 4100 in August. The consumption of 3700 flasks in September was the highest figure attained since March when there were heavy demands for the metal.

Cobalt metal and compounds have been placed under control in the U.S.A. by the Director of Priorities, who will make monthly allocations. Of the 1700 tons of cobalt produced annually in the U.S.A., 1500 come from imported African ore. Domestic ore sources are limited to a small area in Pennsylvania, where cobalt is produced as an iron by-product. Certain low-grade deposits in Canada could be placed in production as an emergency supply, and facilities to increase metal-refining capacity at Niagara Falls, N.Y., should be under way by mid-1942. Estimated requirements for 1942 are 400 tons higher than current annual production.

Forthcoming Events

A joint meeting of the Food Group and the London Section of the **Society of Chemical Industry** will be held on **January 5,** at 2.15 p.m., in the rooms of the Chemical Society, Burlington House, W.1, when Mr. G. A. Freak, B.Sc., F.I.C., will lecture on "Insecticides."

The Midlands centre of the **Electrodepositors' Technical Society** will hold a meeting on **January 6,** at 4 p.m., at the James Watt Memorial Institute, Birmingham, when Mr. F. J. Dobbs, B.Sc., will speak on "Zinc Plating Processes." This will be followed by a meeting of the London branch on **January 12,** at the same hour, in the Northampton Polytechnic, St. John Street, E.C.1., when Dr. S. Baier will lecture on "Practical Problems in Electro-Tinning."

The third and last of the series of meetings so far arranged to discuss the improved use of fuel and power in industrial plants (*see* THE CHEMICAL AGE, December 13) will take place on **January 8,** at 2.30 p.m., in the lecture theatre of the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, when Dr. E. S. Grumell, D.Sc., F.Inst.F., chairman of the Fuel Efficiency Committee of the Ministry of Mines, will open the discussion.

An open conference on the general topic of "Science and the War Effort" will be held in London under the auspices of the **Association of Scientific Workers,** on **January 10** and **11,** from 10 a.m. to 5 p.m., in the Caxton Hall, Westminster. The conference will be opened by the President of the A.Sc.W., Mr. R. A. Watson Watt, F.R.S.

A joint meeting of the **Institution of Chemical Engineers** and the **Chemical Engineering Group** will be held on **January 12,** at 2.30 p.m., in the Rooms of the Geological Society, Burlington House, Piccadilly, W.1, when a paper on "Evaporation of Liquids in Currents of Air" will be presented by Dr. S. H. Wade, A.R.C.S., D.I.C.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Satisfaction

JAMES BRANDON AND SONS, LTD., London, E., dealers in erinoid and celluloid goods. (M.S., 3/1/42.) Satisfaction, December 9, £1500, registered May 11, 1938.

Company News

The Egyptian Salt and Soda Co., Ltd., announce a dividend of 3s. 5.42d. per share, less tax, for the year to August 31, 1941.

William Briggs and Sons, Ltd., report net profit for the year ended September 30 of £27,200 (£34,392), and have declared a final dividend of 17½ per cent., making 20 per cent. for the year (12½ per cent.).

Chemical and Allied Stocks and Shares

ALTHOUGH business in the stock and share markets has again been on a small scale, the general tendency in security values was firm. There was an attitude of caution, awaiting the next war developments, but the trend in British Funds, and the Prime Minister's important American visit assisted sentiment. Current expectations are that the upward trend in gilt-edged stocks will be continued, bearing in mind the weight of money awaiting investment, and that over a period the tendency in gilt-edged is likely to have an important influence on most sections of the Stock Exchange. From time to time, fluctuations must be expected in accordance with the nature of the war news, but confidence in the ultimate outcome of the war, and willingness to be prepared to take a long view, are factors which prevent any heavy selling. Consequently, many stocks and shares have been in short supply in the market, and this partly explains the rise in security values during the past twelve months. As far as industrial shares are concerned, the strength of the balance-sheet and the scope for recovery in dividends after the war are more important influences on values than the question of immediate dividend yield. In fact, the prevailing view is that dividends of leading companies playing a vital part in the war effort are likely to show little change during 1942.

Shares of chemical and kindred companies have reflected the better conditions which developed in the stock and share markets during the past few days. Imperial Chemical are 32s. 9d. at the time of writing compared with 32s. a week ago, while the 7 per cent. preference units made the higher price of 34s. 4½d. Lever and Unilever held their recent improvement, having continued to show activity around 29s., on market hopes that a better dividend than last year's 5 per cent. may be in prospect. B. Laporte were inactive, but remained firmly held and were unchanged at 63s. 9d., and Fison Packard were again 36s. 10½d. There was a favourable tendency in United Molasses, which were 30s. compared with 29s. 9d. a week ago, while following a small decline the units of the Distillers Co. rallied, and at 72s. 9d. were higher on balance. On the other hand, Dunlop Rubber moved down further to 31s. 9d., having again been reactionary, in common with many other shares of companies with interests in the Far East. Turner and Newall improved to 66s. 10½d. although they are now "ex" the recently-declared dividend.

Elsewhere, British Match rose by 3d. to 34s. 6d., and there was again activity in British Plaster Board 5s. shares, which moved up to 20s. Associated Cement were 48s. 9d. and Tunnel Cement around 40s. Market hopes that it may be possible to keep the dividend at 7½ per cent. were reflected by firmness in Borax Consolidated deferred at 30s. 6d. In other directions, British Aluminium were steady around 45s. 6d., and British Oxygen had a firm appearance at 66s. 10½d. Shares of companies identified with plastics continued to show a fair amount of activity, with British Industrial Plastics 2s. ordinary quoted at 3s. 3d. and Erinoid 5s. ordinary at 7s. 6d. Business ranging between 50s. and 51s. 3d. was recorded in Thos. De La Rue. Elsewhere, Greeff-Chemicals 5s. ordinary were around 5s. 9d. and Monsanto Chemicals 5½ per cent. preference continued to be quoted at 22s. 6d.

Awaiting the dividend announcement, Nairn and Greenwich were 59s. 4½d., but Dorman Long, whose dividend is also impending, were easier at 20s. 6d. Tube Investments were 86s. 3d., and Stewarts and Lloyds 46s. Wall Paper Manufacturers deferred units remained at 25s. Boots Drug showed firmness at 36s. 3d. and Sangers were 19s.; the interim dividend announcement of the last-named company is now due. Beechams Pills 2s. 6d. deferred shares remained around 10s. British Glues 4s. units changed hands up to 7s. at one time. Most oil shares were lower on balance, but a further small improvement was shown in Trinidad Leaseholds.

British Chemical Prices

Market Reports

THERE has been no apparent falling off in the volume of inquiry during the past week and most sections of the market report a fairly active demand. Makers' deliveries against contracts have been steadily maintained, and the movement into consumption in the aggregate has been substantial. In the acid section, oxalic, tartaric and citric acids are in keen request with offers scarce, whilst acetic acid continues to be absorbed in good quantities. Amongst the soda products an active inquiry is circulating for hyposulphite, and values for chlorate and yellow prussiate are strong on a tight market. There is no change in the position of the potash products, supplies remaining on the short side with values firm. Price conditions throughout the market for coal tar products remain steady at recent levels with a firm undertone. A moderate volume of inquiry is circulating for both solvent and heavy naphthas, xylol and toluols, and in other directions the market is quiet, pending further information about the control measures.

MANCHESTER.—Although perhaps less pronounced than usual at this time of the year, the past week has witnessed a certain amount of interference with the movement of supplies of the leading heavy chemicals against contracts on the Manchester markets, whilst traders have also reported a seasonal contraction in the volume of new buying interest. On balance for the week there has been relatively little movement of prices, the general tendency being towards still higher levels, and further advances in the near future would occasion no surprise. Among the by-products there has been a fair call for contract deliveries of crude tar, creosote oil, cresylic and carbolic acids, and the general run of light materials.

GLASGOW.—In the Scottish heavy chemical trade business has been slightly better during the past week, no doubt owing to a possibility of an increase taking place from the new year. Export business is very quiet, and this is no doubt due to the uncertain state of the country at the present time.

Price Changes

Carbolic Acid.—Crystals, 9½d. to 11½d. per lb., according to quantity. Crude, 3s. 3d. to 4s. 6d. per gal., according to specification.

Cresylic Acid.—MANCHESTER: Pale, 99/100%, 5s. 4d. per gal.

Glycerine.—Chemically pure, double distilled, 1260 s.g., in tins, £4 to £5 per cwt., according to quantity; in drums, £3 12s. 6d. to £4 6s. per cwt. Refined, pale straw industrial, 5s. per cwt., less than chemically pure.

Rapeseed Oil, Crude.—£46 5s. per ton.

Sodium Phosphate.—MANCHESTER: Di-sodium, £23 to £25 per ton; tri-sodium, £25 to £30 per ton, d/d.

Tartaric Acid.—MANCHESTER: 4s. 3½d. to 4s. 4d. per lb.

Ruhrchemie A.G., joint subsidiary of 80 per cent. of the coal mines in the Ruhr district, has formed a new company for the manufacture of valuable products from hydrocarbons by a new process. The output of the company was maintained in 1940-41 and in some sections increased, but profits are unchanged, as Ruhrchemie A.G. had to bear the loss incurred by Ruhrbenzin A.G., the synthetic petrol producer.

Following the formation of Stickstoff-Ost G.m.b.H. and Superphosphat-Ost G.M.b.H. (*see* THE CHEMICAL AGE, December 20), it is now announced that a new company, Chemie-Ost G.m.b.H., has been formed "in order to assist chemical factories in the occupied eastern territories with advice and action." Which chemical plant is to be put into operation will be decided by the German authorities who will also supply the managers.

The new phosphatic fertiliser cartel which is reported to have been formed in Berlin consists of Thomas-Phosphat-Fabriken G.m.b.H., Deutsche Superphosphat-Industrie G.m.b.H., Kalichemie A.G., Berlin, and Chemische Fabrik Kalk G.m.b.H., Cologne. The new cartel is known as Grossdeutscher Phosphatverband, and an agreement has been concluded with the Stickstoff-Syndikat G.m.b.H. covering the mixed fertiliser of the latter. The union will thus control the distribution of all phosphatic fertilisers in Germany.

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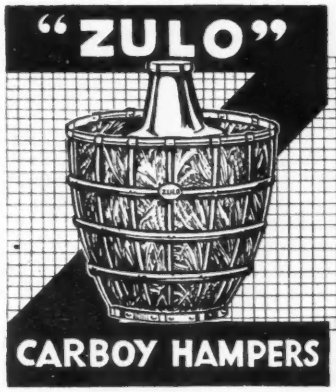

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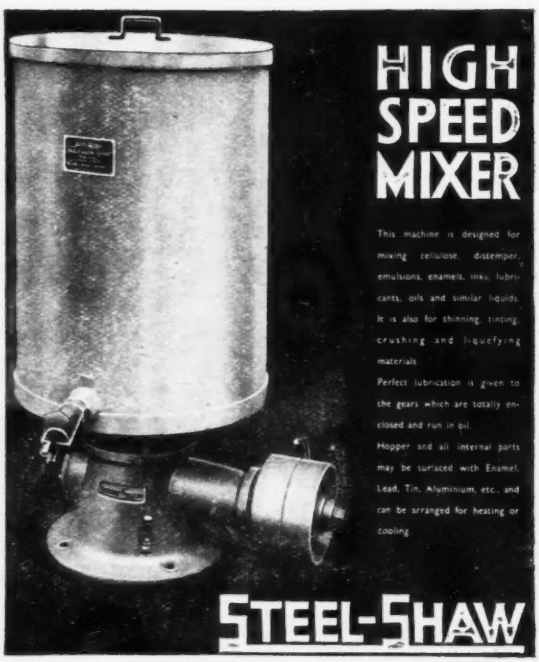
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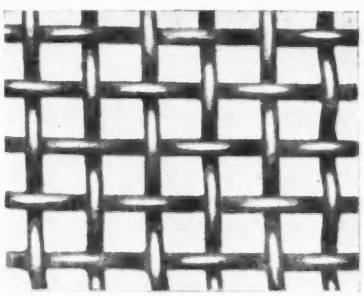

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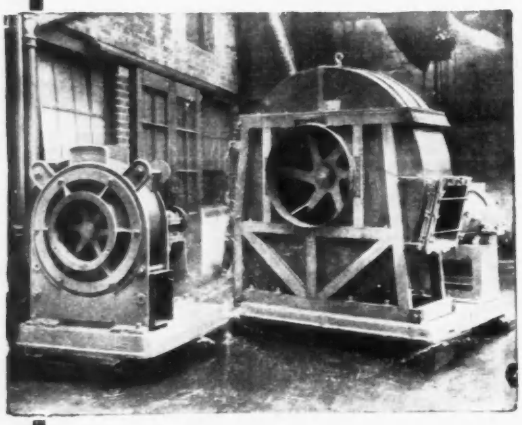

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